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A Cross-Sectional Examination of Changes in Anxiety Early after Acute Myocardial Infarction

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BACKGROUND: Anxiety is common after AMI. The assessment and treatment of anxiety early after acute myocardial infarction (AMI) is important because anxiety is associated with increased morbidity and mortality. Few data exist about anxiety early after AMI, the time when anxiety likely peaks. Furthermore, no researchers have evaluated potential gender differences in the evolution of anxiety after AMI.

OBJECTIVES: The purpose of this study was to investigate the evolution of anxiety during the first 72 hours of hospitalization for AMI and to examine whether there is a gender difference in the pattern of anxiety early after AMI.

METHODS: In this cross-sectional study, 486 patients with AMI were recruited from four urban university medical centers and two private hospitals in the United States and one large university teaching hospital in Australia. Using the Spielberger State Trait Anxiety Inventory, anxiety was measured once in each patient within 72 hours of their admission to the hospital. Patients were divided into 6 groups based on the time interval in which they were interviewed.

RESULTS: The mean score of state anxiety of 39 ± 13 . Peak anxiety occurred within the first 12 hours after AMI ($P < .05$) and anxiety level differed among the time intervals ($F(5, 474) = 4.55, P < .001$). There was a main effect of gender on anxiety ($F(1, 474) = 11.86, P < .001$). Women reported higher anxiety than men at all time points except the time interval of 24.1 to 36 hours after AMI.

CONCLUSION: Anxiety should be assessed and treated in the early stages of AMI to prevent potential complications that may be exacerbated by anxiety and to provide comfort to AMI patients. Prospective research is needed to further portray the trajectory of anxiety in AMI patients.

Anxiety is defined as a feeling of fear, tension, panic or the expectancy that something unpleasant is going to happen.¹ Anxiety is a common reaction to acute myocardial infarction (AMI)² and frequently prompts critical care practitioners to initiate a psychiatric consult for patients with AMI.^{3,4} Up to 26% of patients admitted with AMI are more anxious than patients diagnosed with a psychiatric disorder.^{5,6} Anxiety is expected to a degree in all patients with AMI;⁷⁻⁹ however, it can debilitate some patients.

Evaluation of the relationship between AMI and anxiety is important because anxiety negatively impacts recovery and long-term prognosis. Although the exact mechanism is not known, it is thought that severe or untreated anxiety activates the sympathetic nervous system and hypothalamus-pituitary-adrenal (HPA) axis and contributes to recurrent cardiac events.¹⁰⁻¹³ Moser and Dracup reported that patients with AMI and high anxiety had a higher incidence of lethal ventricular dysrhythmias, myocardial ischemia, and reinfarction during their hospital stay.⁵ Other investigators concluded that high anxiety after AMI predicts 3 month survival,¹⁴ recurrent cardiac events within the first year,¹⁵ functional status at 1 year,¹⁶ and adverse cardiac events and mortality within 6-10 years after AMI.¹⁷

Historically, investigators have not focused on whether men and women differ in the outcomes after AMI; however, from 1985 to the present, more women than men have died annually from CHD.¹⁸ Results from a study of over 354,000 patients indicated that females have higher in-hospital mortality rates than males.¹⁹ Some investigators have reported that women had more in-hospital complications and higher mortality 30 days after AMI than men.^{20,21} Independent of comorbidity, age, or prior angina, women from Spain had a higher risk of death than men both 28 days and 6 months after their first AMI.²² In a follow-up study, these investigators reported higher mortality rates 28 days after AMI for 65-74 year-old women but no

association between gender and three year survival rates.²³ Female gender independently predicted early death after AMI for patients less than 65 years old.²⁴ Similarly, after adjusting for age, comorbidities, severity of illness, and various treatment strategies, Vaccario and colleagues found that women less than 75 years old had a 49% higher in-hospital mortality rate following AMI and that women 75 years old and older were 46% less likely to die during hospitalization for AMI.²⁵ In a later study, these investigators reported that women younger than 60 years old had higher mortality rates than men two years after AMI.²⁶ In another study, the survival rate 10 years after AMI was lower for females than males.²⁷ In contrast, some researchers found that gender did not predict outcomes after AMI.^{28, 29}

In the general population, anxiety is more prevalent in women than in men.³⁰⁻³² Kim and colleagues reported that within 72 hours after AMI, women had higher levels of state anxiety than men.³³ Results of a prospective, international study indicated that females from Australia, England, Japan, South Korea, and the United States were more anxious after AMI than men from these countries.³⁴ This relationship persisted even after accounting for various psychosocial and physiologic variables. Uuskula reported that young females (mean 38.6 years) have higher state anxiety levels than young (mean 37.3 years) males in the first week post-AMI.³⁵ Conversely, others did not find differences in anxiety between men and women after AMI.^{6, 8, 36, 37}

Women with elevated anxiety levels after AMI may have higher morbidity and mortality rates. Both state anxiety and female gender predicted recurrent acute coronary syndromes within the first year of AMI.¹⁵ Results from a prospective, multicenter study indicated that women with high anxiety were five times more likely than men to develop in-hospital complications after AMI.³³ Interestingly, among patients referred for exercise testing, female gender predicted higher mortality at 5 years and higher levels of anxiety were associated with *lower* mortality.³⁸

In spite of this convincing evidence, many clinicians fail to assess and treat anxiety. Health care providers often undervalue the assessment of anxiety,^{39, 40} do not use an anxiety assessment tool to objectively and accurately measure anxiety,⁴¹ underdiagnose anxiety in patients with CHD,⁴² and are unaware of the physiologic consequences of anxiety.³⁹ Additionally, clinicians often rely on changes in objective assessment parameters to indicate elevated anxiety.^{40, 43} Yet, critically ill patients with elevated anxiety may not exhibit obvious changes in their condition because physical symptoms of anxiety are often masked by the symptoms of cardiac disease such as chest pain, shortness of breath, rapid pulse, elevated blood pressure, and palpitations. Finally, clinicians often are not trained adequately to assess and treat anxiety.^{39, 40}

In most investigations of anxiety after AMI to date, investigators measured anxiety several days^{5, 8, 15, 35, 41, 44, 45} and to weeks^{46, 47} after AMI. Thus, there are few data regarding anxiety in the early hours after AMI, the time when anxiety likely peaks.^{48, 49} Riegel and Gocka reported that post-AMI patients had significantly lower anxiety scores four months after AMI than one month after AMI.⁴⁷ Havik and Maeland assessed the anxiety level of patients with AMI twice during their hospitalization and four times during the next three to five years.⁴⁶ Although subgroups of patients manifested mixed responses, average anxiety levels were stable during hospitalization, increased for one to two weeks after discharge, and then stabilized. Interestingly, average post-discharge anxiety levels were higher than the inpatient anxiety levels. In another study, patients experienced a gradual decrease in anxiety over the first year after their AMI.⁵⁰

To our knowledge, no researchers have evaluated potential gender differences in the evolution of anxiety after AMI. The appropriate treatment of anxiety after AMI depends on an

anxiety assessment early after AMI and knowledge of how anxiety changes over time post-AMI. In addition, an understanding of potential gender differences in the evolution of anxiety after AMI will enable clinicians to focus their efforts on high risk patients. Accordingly, the purposes of this study were to: (1) investigate, using a cross-sectional design, the evolution of anxiety during hospitalization for AMI; and (2) examine whether there is a gender difference in the pattern of anxiety early after AMI. Our primary research hypotheses were: 1) peak anxiety levels will occur during the first 12 hours after AMI and, 2) women will report greater anxiety than men.

Methods

Design: In this multicenter, cross-sectional study, we measured anxiety once in each patient within 72 hours of their admission to the hospital for AMI symptoms. Anxiety was measured at different points within this 72 hour time frame for each patient based on their availability. Using this structure, we divided patients into six groups based on the time at which anxiety was measured: 1) within 12 hours of admission; 2) 12.1 to 24 hours after admission; 3) 24.1 to 36 hours after admission, 4) 36.1 to 48 hours after admission, 5) 48.1 to 60 hours after admission, and 6) 60.1 to 72 hours after admission. This design is not ideal for examination of changes across time. However, it is extremely useful and an acceptable alternative to a longitudinal design when investigating patient populations where there is a legitimate concern for imposing undue patient burden. Moreover, a cross-sectional design can even be preferable when excessive measurements within a short time frame could spuriously alter patients' responses. Thus, a cross-sectional design is appropriate when making inferences about processes that evolve over time.⁵¹

Patients and Settings: Patients were recruited from coronary care units in four urban university medical centers and two private hospitals in the United States and one large university teaching hospital in Australia. Patients were eligible for enrollment if they met the following criteria: (1) diagnosis of AMI confirmed by elevated cardiac enzymes and diagnostic electrocardiographic changes; (2) free of cognitive impairment that might interfere with their ability to complete a 15-20 minute interview; and (3) free of serious or life threatening noncardiac comorbidities, such as sepsis, stroke, or acute renal failure. Patients with a peri-procedural AMI were excluded because they might exhibit a different pattern of psychological distress.

Measurement: Anxiety was measured using the 20-item state anxiety subscale of the Spielberger State Trait Anxiety Inventory (STAI). Using this inventory, patients rate how they feel at the present; responses range from 1 (not at all) to 4 (very much so). The instrument is scored by totaling the responses; therefore, scores can range from 20 to 80. Higher scores indicate higher levels of anxiety. Normative values for healthy adults aged 50 to 60, general psychiatric patients, general medical-surgical patients, and the average state anxiety scores in a sample of cardiac patients are shown in Table 1. Alpha coefficients for the internal consistency reliability of this scale ranged from 0.86 to 0.95 from high school students, working adults, military recruits, and college student samples.⁵² Numerous investigators have used the STAI to assess anxiety in patients with AMI and other illnesses. Reliability of the STAI in this study was 0.94 per Cronbach's α , a finding that equals reliability values reported by other investigators.^{39, 41, 44}

Procedures: The study underwent ethical review and was approved by the Institutional Review Board or its equivalent at each site. Trained research assistants explained the study to eligible patients and obtained written informed consent from each participant. These research assistants were experienced cardiovascular nurses with training in interview and clinical data collection

techniques. Patients were interviewed within 72 hours of admission to the hospital using a sociodemographic data collection form to obtain selected sociodemographic and clinical data, and the STAI to determine their anxiety level. In addition, clinical data were obtained from the medical record. Patients were given the option of completing the instrument on their own or having the research assistants read the instrument to them. Most patients chose to have the research assistant read the instrument to them.

Data analysis: All data were entered into a personal computer and analyzed using SPSS software, version 11.5. Data regarding level of anxiety after AMI are presented as means \pm standard deviations. We conducted two-way analysis of variance (ANOVA) testing to evaluate whether the six groups differed by mean anxiety score and to determine if males and females differed in their mean anxiety scores. Post-hoc comparisons were made using Fisher's Least Significant Difference (LSD) test to identify which groups differed in anxiety across time. A *P*-value of $< .05$ was considered statistically significant.

Results

Characteristics of the Sample

Four hundred eighty-six AMI patients were enrolled in this study, including 351 (66.5%) men and 175 (33.1%) women. The sociodemographic and clinical characteristics of the sample are summarized in Tables 2 and 3. The mean age of the patients enrolled in this study was 62 ± 13 years. The majority of patients were Caucasian (85.2%) and married (68.8%).

Anxiety levels

The overall mean state anxiety score for this sample was 39 ± 13 with a range of 18 to 80. Both men and women reported higher anxiety than seen in the age-specific normative group of healthy adults.¹ Although the overall mean anxiety score of 38.1 was less than the mean anxiety

score of general medical surgical patients, 35% of patients with AMI reported higher anxiety levels than the medical surgical patients¹. Additionally, both men and women in this study reported higher anxiety than cardiac patients in a previous study.⁴⁵

Evolution of Anxiety

The average time between admission to anxiety assessment in this study was 29.6 ± 15.8 hours with a range of 1.2 to 71.3 hours. For the purpose of this study, patients were divided into six groups based on when their anxiety was measured. The number and percentage of patients who fell into each group and the mean anxiety scores in each group are shown in Table 4. As shown in Figure 1, anxiety level differed among the time intervals ($F(5, 474) = 4.55, P < .001$). Results of the LSD procedure supported the first hypothesis that peak anxiety occurred within the first 12 hours after AMI ($P < .05$). The ANOVA test revealed a main effect of gender on anxiety ($F(1, 474) = 11.86, P < .001$) and supported our second hypothesis. Women reported higher anxiety than men at all time points except the time interval of 24.1 to 36 hours after AMI (Figure 2).

Discussion

This cross-sectional study was conducted to examine the evolution of anxiety early after AMI and to determine whether there were gender differences in anxiety after AMI. Anxiety levels were highest within the first 12 hours after admission, decreased over the next 12 hours (12-24 hours after admission), and remained steady for the successive 36 hours before increasing 60-72 hours after admission. These findings are unique because unlike previous investigators,^{6, 8, 14, 35, 45, 53-55} we enrolled a large sample with a greater proportion of women and measured anxiety as early as 1.2 hours after admission for AMI.

We found no other studies in which anxiety was measured as early after admission for AMI. Other investigators who have attempted to capture the early anxiety experience, typically have measured anxiety within the first 48 to 72 hours or within the first one to weeks. For example, Froese and associated reported that patients were most anxious one to two days after admission to the coronary care unit (CCU).⁵³ Billing and colleagues found that patients were most anxious in the intensive care unit; however, they measured anxiety 48-72 hours after admission.⁵⁶ In an landmark study, Cassem and Hackett reported that patients were anxious on admission to the CCU, and anxiety was the most frequent reason for psychiatric consultation within the first two days of admission.⁴ In a small study of men with AMI, patients were more anxious throughout the first four days of hospitalization than six months after discharge.⁵⁵ Havik and Maeland described stable levels of anxiety during hospitalization after AMI; however, these investigators first assessed anxiety 6-10 days after admission for AMI.⁴⁶ Philip and colleagues measured anxiety following the patient's transfer out of the CCU and noted that patients were most anxious the first day on the medical unit.⁵⁷ At present, CCU stays often range from 48-72 hours; therefore, our findings of higher anxiety 60.1-72 hours after AMI may reflect pre-transfer anxiety.

The overall mean anxiety score of 39 for our patients was similar to previously reported anxiety levels that ranged from 37-43.^{6, 37, 39, 41, 44} Consistent with other studies, women in our study had higher overall levels of anxiety than men.^{35, 44, 45, 50} As shown in figure 2, the anxiety levels of men and women followed a similar trajectory until 36 hours after admission. Of particular interest is the wide spread in anxiety scores between men and women from 60.1 to 72 hours after admission. This divergence may explain the significant finding that overall, women have higher anxiety scores than men; however, this is speculative because post-hoc analyses

could not be performed due to the small number of patients who were interviewed during this time period. Further research is needed to further describe the pattern of gender differences in anxiety after AMI.

Given recent advances in medical care of AMI patients, it is important to re-examine anxiety in the early post-AMI period. Most previous studies regarding the time course of anxiety following AMI were conducted from 1970-1990. During the last two decades, there have been extensive advancements in providing cardiovascular care to patients with AMI. For example, fibrinolytic therapy and primary percutaneous transluminal coronary angioplasty with stent placement often contribute to rapid pain relief and preserved myocardial function. Furthermore, intra-aortic balloon pumping and newer pharmacologic agents have improved outcomes after AMI. Therefore, the general public and patients may perceive AMI as less debilitating and more survivable. Additionally, insurance policies often impact the duration of hospital stay and follow-up care after AMI and thus may influence anxiety.

Our finding that peak anxiety occurs during the first 12 hours after admission for AMI has relevance for clinicians caring for AMI. Because anxiety peaks during the first 12 hours after admission, it is critical that clinicians assess and treat anxiety during this time period. Although we did not directly evaluate the consequences of anxiety, others have shown that anxiety adversely impacts cardiac morbidity and mortality.^{5, 14-17, 33} The prompt assessment and treatment of this anxiety may prevent undesired outcomes.

This study is limited by its cross-sectional design; prospective, longitudinal studies are needed to further portray the trajectory of anxiety in AMI patients. However, cross-sectional studies remain important because serial, longitudinal measures are excessively burdensome to acutely ill cardiac patients. Additionally, cross-sectional studies can be useful to justify a more

complex and lengthy study. A further limitation of this study is that we enrolled limited numbers of patients into the first and last two time intervals. We enrolled patients based on the availability of trained researchers and eligible patients without regard to preconceived judgments about the patient's level of anxiety. Nevertheless, to our knowledge, we are the first to study anxiety this early after AMI.

In summary, results of this cross-sectional analysis indicate that anxiety levels were highest within the first 12 hours of AMI. Additionally, women reported higher levels of anxiety than men, especially 60.1-72 hours after AMI. The prompt assessment and treatment of anxiety after AMI may prevent potential complications and comfort patients who are vulnerable to psychophysiologic stress.

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Table I

Normative and comparative values of state anxiety

	Healthy Adults, Aged 50-60*	General Psychiatric Patients*	General Medical Surgical Patients*	Cardiac Patients**
State Anxiety	Men: 34.51 ± 10.34	47.74 ± 13.24	42.38 ± 13.79	Men: 33.66 ± 10.39
(Mean \pm SD)	Women: 32.20 ± 8.67			Women: 36.99 ± 11.55

*Spielberger et al., 1983¹**Sykes et al., 1989⁴⁵

Table II

Sociodemographic characteristics of the sample (N = 486)

Sociodemographic Characteristics	
Age (years)	62 ± 13
Education (years)	13 ± 3
	N (%)
Gender	
Men	351 (66.5)
Women	175 (33.1)
Race	
Caucasian	450 (85.2)
African American	32 (6.1)
Asian	20 (3.8)
Hispanic	15 (2.8)
Middle-eastern	7 (1.3)
Marital Status	
Married	363 (68.8)
Widowed	73 (13.8)
Divorced	48 (9.1)
Single	32 (6.1)
Separated	7 (1.3)
Co-habitate	2 (0.4)
Yearly Income	
<\$5,000	27 (5.1)
\$5,000-\$20,000	141 (26.7)
\$20,000-\$40,000	145 (27.5)
\$40,000-\$60,000	87 (16.5)
>\$60,000	69 (13.1)

Values in table are mean ± standard deviation or actual number of patients followed by percentage in parentheses. Column percents may not equal 100% due to missing data.

Table III

Clinical characteristics of the sample (N = 486)

Characteristic	N (%)
History of hypertension	297 (56.3)
History of diabetes mellitus	113 (21.4)
Current smoker	178 (33.7)
Previous myocardial infarction	142 (26.9)
Previous angina	179 (33.9)
Previous coronary artery bypass surgery	45 (8.5)
Previous percutaneous transluminal coronary angioplasty	87 (16.5)
Killip classification on admission	
I	318 (60.2)
II	159 (30.1)
III – IV	45 (8.5)

Table IV

Anxiety level in each time period by gender

Time Interval	N (%) Men / N (%) Women	Men	Women	Total
First 12 hours	47 (13.4) / 18 (10.3)	43.38 \pm 11.72	47.89 \pm 13.30	44.63 \pm 12.24
12.1 to 24 hours	84 (23.9) / 51 (29.1)	36.10 \pm 12.59	39.25 \pm 9.87	37.29 \pm 11.70
24.1 to 36 hours	99 (28.2) / 32 (18.3)	37.69 \pm 12.39	37.34 \pm 11.29	37.60 \pm 12.09
36.1 to 48 hours	56 (16.0) / 34 (19.4)	34.68 \pm 10.88	40.38 \pm 10.97	36.83 \pm 11.20
48.1 to 60 hours	30 (8.5) / 21 (12.0)	35.30 \pm 10.21	39.00 \pm 9.95	36.82 \pm 10.17
60.1 to 72 hours	11 (3.1) / 3 (1.7)	32.36 \pm 11.58	49.00 \pm 9.64	35.92 \pm 12.95

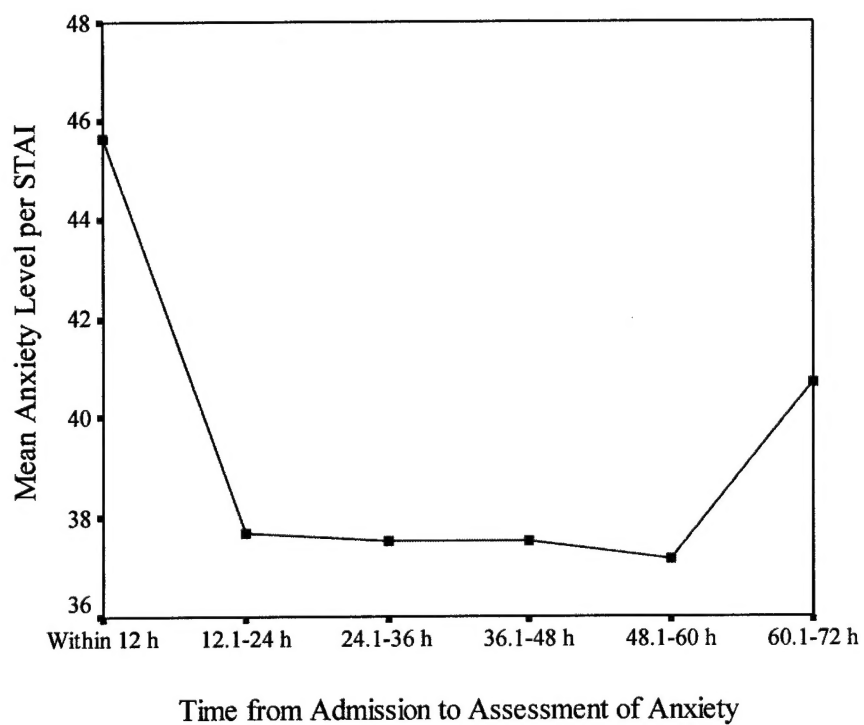


Fig 1 A cross sectional analysis of anxiety by time. Anxiety levels differed among the time periods ($P < .001$). Anxiety levels within the first 12 hours were higher than the other five time periods ($P < .05$).

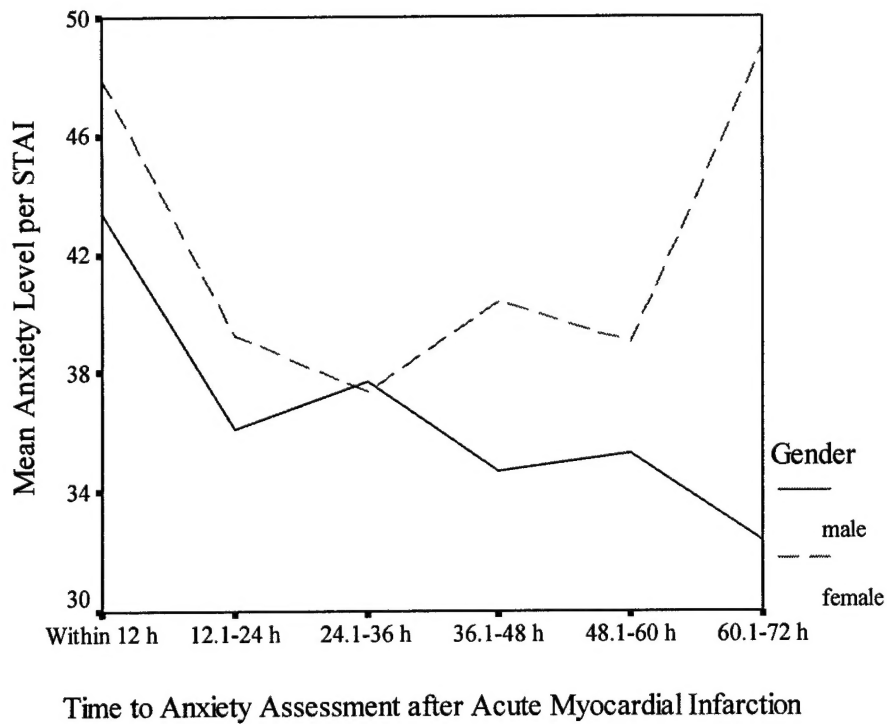


Fig 2 Gender Differences in Anxiety after Myocardial Infarction. Overall, women reported higher anxiety than men ($P < .001$).